The Northern and Central Oases of the Province of Mendoza (Argentina): water resources and sustainability challenges

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Oasis dans la mondialisation : ruptures et continuités

Oases in the globalization: ruptures and continuities

Conception : direction de la communication, Université Paris 13 - Novembre 2013

Actes du colloque - 16/17 décembre 2013 - Paris

Proceedings of the Colloquium - 2013 December 16th/17th - Paris

Organisé par / organized by
Anaïs MARSHALL, Emilie LAVIE, Jean-Louis CHALEARD, Monique FORT & Jérôme LOMBARD

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The Northern and Central Oases of the Province of Mendoza (Argentina): water resources and sustainability challenges

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Pendant les dernières décennies du 20ème siècle, les oasis de Mendoza, au cœur de la diagonale aride sud-américaine, ont connu de profondes mutations de leur modèle socio-économique, fondé sur l'agriculture et les industries agro-alimentaires. La mondialisation, Mendoza l'a connue assez brutalement : la crise économique du Mercosur des années 2000 – suivant de près celle des marchés asiatiques (1997-98) – a entrainé un afflux massif d'investissements internationaux, malheureusement localisés sur l'oasis Centre, aux dépens de l'oasis historique, l'Oasis Nord. Tandis que celle-ci subit une très forte pression démographique et industrielle entraînant une pollution marquée de l'eau d'irrigation, l'oasis Centre connaît un véritable boom économique. C'est ainsi toute la structure sociale de la province qui est bouleversée, ce qui se manifeste géographiquement par une inversion des centralités-périphéries.

Keywords: irrigated areas, water resources, impact, anthropogenic activities, future
Mots clés : aires cultivées, ressources en eau, impacts, activités anthropiques, enjeux

Introduction

Over the last decade of the 20th century, the agriculture-based economic development model of Mendoza sustained a great impact. The province has the largest irrigated area in the country with a pre-colonial tradition of irrigation, mostly superficial, of its arid soils (200 mm of rainfall per year) under a Mediterranean crop system: grapes, olives and stone fruits. The phenomenon of economic globalization reached our country together with the Southeast Asian and Mercosur crises, at a time when Argentina had an open economy with a 1:1 exchange rate to the U.S. dollar, which was attractive to foreign investors. In the oasis of the Province of Mendoza (central-western Andean region, between 32º and 38º south latitude, and between 66º 30' and 70º 30' west longitude) there are two different situations: Northern and Central Oases (see Figure 1):

Marshall A., Lavie E., Chaléard J-L., Fort M., Lombard J. *Dir*. (2014).
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Proceedings of the international colloquium *Oases in the globalization: ruptures and continuities,* Paris, 2013-December 16-17

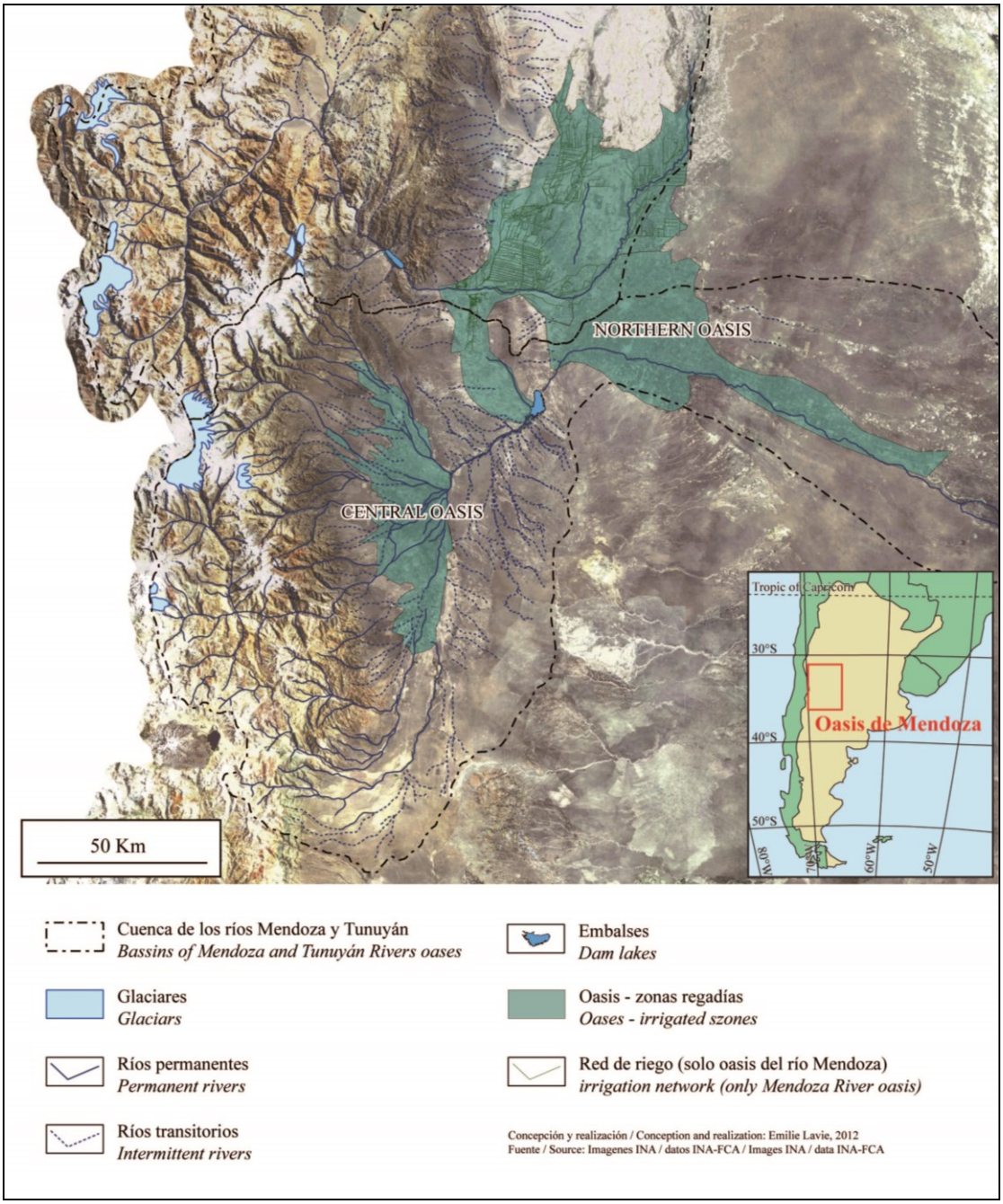

Figure 1: Northern and Central Oases of the Province of Mendoza - Argentina

The Oases (description of the problem)

-The **Northern Oasis** (80,000 hectares) is irrigated with waters from the Mendoza (50 m^3 s^{-1}) and Lower Tunuyán rivers. It was the first area settled in what is now Greater Mendoza (1 million inhabitants), with a strong agriculture-based industry (wineries, food canning plants, olive oil plants, etc.). The Mendoza River feeds an underground aquifer, the natural water reservoir of the oasis, which is beginning to show signs of depletion and contamination attributable to overexploitation and obsolescence or to poor maintenance of the oldest wells.

-The **Central Oasis** (54,000 hectares) is in the upper subbasin (*Valle de Uco)* of the Tunuyán River (30.6 m^3 s^{-1}). Some 17 % of the flow of the river and of a significant system of brooks is used here; the remaining 83 % flows into the *El Carrizal* reservoir to irrigate the lower subbasin. The old horticultural model is being replaced with one of quality vineyards using groundwater and drip irrigation. A combination of large areas with suitable piedmont soils, favorable eco-climatic conditions (large thermal amplitudes) and top water quality (snowmelt) have made it possible for the traditional Malbec cultivar to achieve maximum expression and to be known, appreciated and sold overseas. The export trend from 1999 to 2009 has increased by 400 % (see Figure 2).

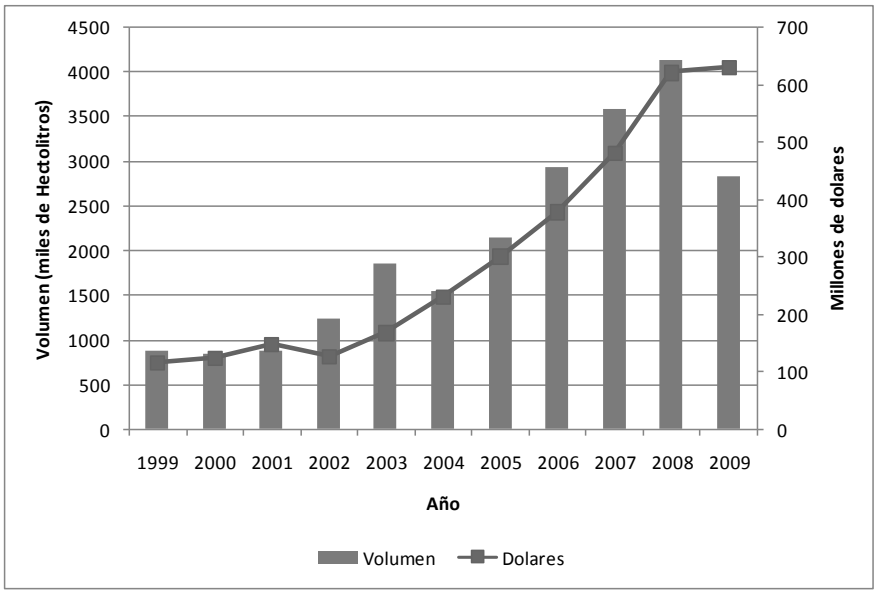

Figure 2: Argentine wine exports (volume and US dollars)
Source: INV - Argentina

The Northern Oasis has been affected by a strong demographic growth and migration of rural communities, with the resulting loss of suitable production areas to urbanization. The irrigation system, which crisscrosses the main metropolitan area of Mendoza, has turned into a huge urban waste container that collapses during heavy rains and affects distribution (principle of equity) and irrigation application efficiency. The physical, chemical and microbiological contamination of the water supplies completes the picture of the oasis (Fig.3).

Figure 3: Urban waste in irrigation canals: reduced distribution and application efficiency (Salatino, 2011)

The significant increase in the area under cultivation of fine wine grapes in the Central Oasis implies increasing groundwater exploitation. Use of the aquifer (some 2500 wells), which in the past was circumscribed to the intermediate subzone (free aquifer and/or water table), has now expanded to the upper –or aquifer recharge– subzone. This, in turn, has led to rising salinity levels in the many brooks feeding the system in the Lower Tunuyán River subbasin, downstream the *El Carrizal* Dam, in the east of the province (50,000 irrigated hectares). This important agricultural and industrial region comprises cities such as San Martín, Rivadavia and Junín, which have been true examples of Mendoza's agroindustrial potential since the 1950s.

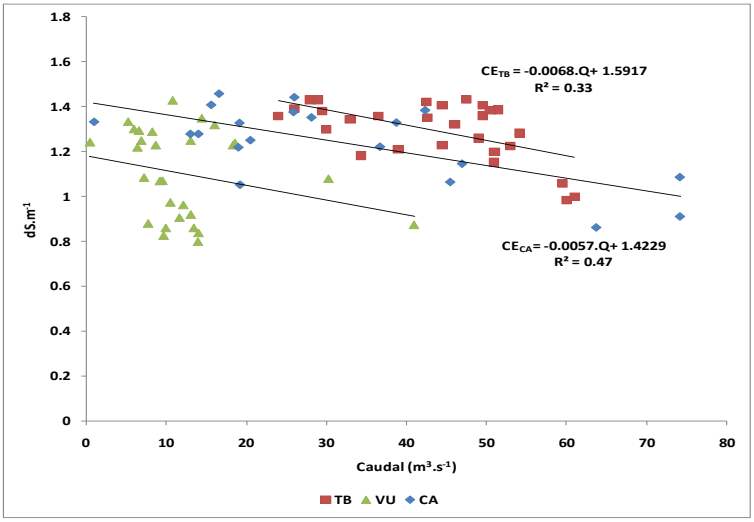

Figure 4: Increasing water salinity in the Lower Tunuyán River. Values in *Valle de Uco* (upper subbasin) vs. *Costa Anzorena* and the *Tiburcio Benegas* dam (lower subbasin)

Reduced water availability and lower water quality –caused by salinization– will affect the economy of small-scale producers in the Lower Tunuyán River Basin and have social impacts (Fig. 4). For example, the production of canning peach varieties has moved to the *Valle de Uco* over the last ten years. Peach is a salt-sensitive crop and the declining water quality

brought about decreasing yields which, in some cases, led to the abandonment of the fruit orchards.

Solutions?

Government officials have focused on education and raising awareness of the problem of urban wastes, on modernization of the irrigation network (canal lining), and on a land use planning law. Construction of new domestic wastewater treatment plants, regular water quality monitoring and the use of performance indicators (Fig. 5) which will help visualize the evolution of water quality in time and space, will contribute to water conservation and sustainability in both oases.

Conclusion

The integrated management of the upper and lower subbasins of the Central Oasis is yet to be implemented. Attention should be paid to the basin's water balance so as to set a limit, on the basis of sound criteria, to the expansion of land under irrigation, especially when groundwater is involved. With regard to the Upper Tunuyán River, though so far the physical, chemical, and microbiological quality of water in its command area has not been affected by human activity, it will be necessary to monitor the flows entering the upper subbasin and its discharges into the lower subbasin.

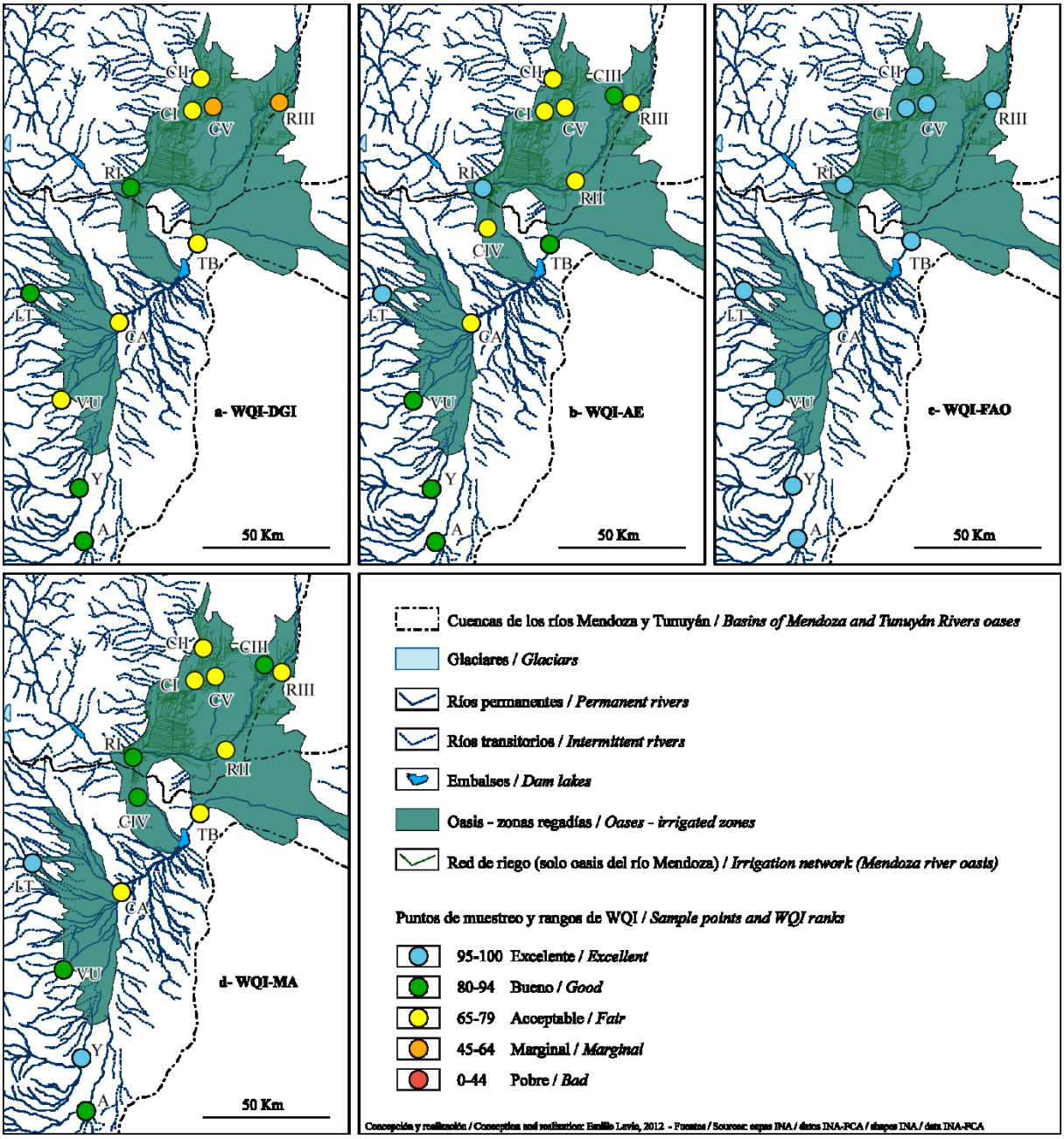

Figure 5: Irrigation water quality using the Integrated Water Quality Index (WQI) (Lavie *et al.*, 2013)

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